

still unacceptable in the USA, had been taken to heart in the 1970s in smaller countries like Sweden, and was the basis of the astonishing increases in GDP of Japan and Korea. The priority-setting that these countries engaged in involved government, industry and the universities, and was a blend of national direction from the highest levels of government and industry with scientific direction from those in the laboratories and in touch with world research trends — a mixture of 'top down' and 'bottom up'. And in these three countries basic research, the kind favoured by academics, was not ranked especially high.

The working-out of these processes has been uncomfortable for the universities. Very simply, research could not be controlled as simply as teaching. If fewer students enrolled, fewer courses or classes could be offered. But research kept widening, and its cost kept growing. Governments could keep a lid on the bubbling research saucepan, but only at the cost of increasing the pressure and the unhappiness within. Moreover, the astonishing growth in research activity had effectively internationalised the research profession, and the best researchers found it easy to move to where the best research could be done. As has frequently been remarked, university people belong to two 'colleges': the one that pays their salaries and the invisible one that determines their intellectual allegiance, usually defined in disciplinary terms. The invisible college controls reputations in research, and since the university world now defined the 'best' academics as those with the greatest reputations in research, universities are in the uncomfortable position of seeing their best staff threaten to leave unless they receive the wherewithal necessary to keep them competitive with their peers, which cuts across traditional notions of 'parity of esteem.'

Period III: From now on, for quite a while . . .

I have not thought it necessary to spend much of my time on the details of the conflict between government and the higher education system. They differ in timing and in heat from country to country. What is important is understanding the engine of that conflict, which can now be seen as sharply differing conceptions of the proper place of research in the modern university. Because I believe that John Ziman's analysis is essentially correct, I believe also that the universities need to think again about research, and why it is done, and who should do it.

I have worked in universities in Britain, the USA and Australia and lectured in and visited universities in several other countries, and they are marked more by their similarities than by their differences. The notion that all academics should do research seems to me defensible only if one

believes that research is somehow good for you.

I will be brutally frank: the notion that all academics are good at research (and should therefore be funded to do it) is bunkum. The notion that without a solid and continuing performance in research an academic simply cannot be an effective university teacher at any level is likewise bunkum. But these two notions are built into the culture and the rhetoric of the modern university, and they need to be given a decent burial. In countries which have a 'dual funding' system these notions are also built into the ways in which universities are funded, so the burial is necessarily a protracted affair, and the wake seems everlasting.

Perhaps it will be thought that I have dismissed these two notions in too summary a fashion. Let me then add a small *douceur*. There are, it seems to me, two indispensable pre-conditions and a further desirable one, if you seek to be an excellent teacher, of anything, at any level. The indispensables are that you should know your subject, and that it should still excite you. Competence and enthusiasm are the base for everything else. The desirable pre-condition is that you should have been trained in the arts and skills of teaching itself. Paradoxically, very few university teachers have any training in those arts and skills. What they have been trained in, if they have their PhD, is research. If continuing activity in research contributes to greater competence in the discipline that one has to teach, rather than to greater knowledge of a tiny specialisation within that discipline, then it is playing a part in the business of teaching.

I remain to be convinced by evidence that it is the only way to establish or maintain competence as a university teacher. I would accept that those undertaking their PhD training should be taught by those who have established their competence in research, for the PhD is a degree in research. But it is not obvious that the needs of undergraduate education should be given by PhD training.

What can be said about the emerging rationale for research in the Period III university is something like this. The university will have to choose what it wants to be good at. In the natural sciences and engineering to be good at something in most fields will involve the expenditure of increasingly large amounts of money. Money will remain limited, even when the system grows. Universities, like countries, will have to collaborate if certain kinds of research facilities are to be available to their staff. Some universities will become known as research institutes which also do some teaching; some will become known as teaching institutions where some research is also done. There will be a wide range in the mixture of research and teaching which is seen to be appropriate for an institution which is called a 'university'. And within universities not

every staff member will be able to do research, let alone the research that he or she would like to do in the best of all possible worlds. Those who do it will have demonstrated their talent for it by performance, or by finding sponsors or patrons, or by the acclaim of their peers.

And here is the human relations problem. Most academics are, in my view, driven not by power, or by riches, or by sexuality, but by the desire to be honoured and esteemed by their colleagues. I do not wish to be misunderstood and I do not have the time to develop this line of argument as I would wish. In this area I am a kind of Adlerian, rather than a follower of Jung or of Freud. It seems to me that the organisation of research, with its prize system, from the Nobel down through fellowships of learned academics, medals, prizes, invitations to give lectures (like this one!), honorary degrees and all the rest, is explicable only if academics are driven by the need to be esteemed. And within the higher education system only one element of life and work is organised to attract esteem — and that is research.

What this means in practice is that appointments and promotions in universities are governed by research performance. It means that there are two classes of academic: the ones who are in a position to do their research and the ones who can't get the money or time to do theirs. It means that when a research-funding body like mine makes a grant it is fundamentally affecting career prospects.

In consequence, research funding bodies are besieged by people who want money to do research because in large they part seek recognition and promotion. In Britain, the USA, Canada and Australia at least, the chance of an academic's gaining a chair is critically affected by her performance in gaining research grants (and much less, I should add, by her performance in deploying them). Failure to gain a grant will in general hold an academic back. It may be that we need indirect mechanisms like this to make sure that humanity gets enough high-quality research done. On this, as on most things, I am open to persuasion. But I have to say that I wish that the people we funded consisted only or mostly of those who delight in the intellectual battle that is at the heart of the research quest, and who do it because it is fun and they get a kick out of it. All this would be less of a worry if peer-review systems in research had chronometer-like precision. But of course they do not. Not only is grantsmanship a real skill, but there are large elements of luck and uncertainty in the process, recognised by all who serve their fellows through membership of peer review panels.

In comparison with research, the other elements of the academic career get pretty short shrift. Teaching is seen by the majority

as just a job, and there are few awards for it. Administration is scorned and administrators are often disliked. Community service is beneath serious notice for many academics. I want to argue that this value system is seriously at odds with the reality of the modern university, and that a more sensible and more humane reward system needs to be developed quickly.

The modern university has many purposes. It advances and communicates knowledge for different reasons and to different audiences. It educates the best of the society's young people and increasing numbers of those older members, who are seeking advanced training or high-level re-training. It depends very largely on other people's money, whether from the government or from the pockets of parents, students or firms. It is important to the society in which it is located for a wide variety of reasons, and that importance is likely to grow, not to diminish. It is a large organisation disposing of annual expenditures that run into hundreds of millions of pounds; since money for the things that the modern university does is abominably scarce it is vital that those expenditures are effectively and efficiently managed.

Yet academics are expected to provide all of this — research expected — without themselves being trained. And with the exception of research again, their efforts, however virtuous and effective they are, are unlikely to be widely appreciated within the university, let alone outside it. Given the shortage of funds for research — and I remind you that if the Ziman argument is accepted the shortage will be continual and the competition for it will be ferocious — the outlook for many academic staff will be grim if research remains the only arena for garnering esteem. There are already a lot of unhappy academics. Their number can only be

expected to grow if nothing changes.

I propose instead a radical rethinking about the academic career. With due acknowledgement to the Lord Buddha I offer as a starting point the concept of The Five-Fold Path to Honour. In the modern university the academic staff member should recognise that she can be expected to contribute to five essential tasks, which can be conceptually distinguished but usually possess some overlap:

- *teaching and learning*, which require no elaboration here
- *research*, the acquisition of new knowledge
- *scholarship*, which I define in this context as the organisation and distillation of existing knowledge
- *collegial administration*, or making the place work, and
- *community service*, meaning the extension of the university to its community, in all its aspects.

These are essential tasks because if any one of them is generally done badly the university will suffer, as finally will the community which supports it. It is therefore essential that all of them are performed well, and further essential that performance in them is measured and evaluated, and that high performance is honoured and celebrated. A great teacher, a great department head or dean, a great popular communicator deserve their fair share of the honour that now goes to the great researcher, and to a lesser extent has always gone to the great scholar. To gain that share their endeavours will have to be rigorously assessed by the best in the field. And that means some kind of peer review system, and the notion of 'best practice'. I do not suggest that this will be easy, or that it can happen within a few months. I am certainly not suggesting a soft

option to the demanding rigors of research.

I envisage a career system in which all paths are critically reviewed. An academic staff member will, at any one time, be pursuing an agreed mix of one or two of these career paths. Over the span of her career, a talented academic may well demonstrate excellence in each one of them. Some academics may explore thoroughly only a couple of these paths. My expectation is that the university will need most of its staff most of the time to provide some teaching, and that such teaching will, if it is any good, be related to scholarship or research.

No doubt the Nobel Prize will continue to be the Holy Grail of science, and no doubt the best researchers will know a wider world than the best teachers. I am not in search of a grey uniformity. But I do suggest that the modern university has to tackle the task of recognising the diversity and the importance of the tasks its academic staff are expected to accomplish, and to provide a career structure in which excellence is the desired performance level in each of the activities that the university regards as essential, and is appropriately rewarded.

If that is done — and it can be done if the will is there to do it — then the modern university will in a few years' time be an exciting and creative place in which to work. More, the quality of teaching ought then to be much higher, there ought to be fewer dismally run departments, and the community will have a genuinely higher regard — and for good reason — for 'its' university. And finally, though most of us in my kind of job will sometimes feel the need to place this first rather than last, rather fewer people will do research, and more good research will be done, and there will be more money to fund it.

The dying of the light

Ian Lowe

Griffith University

The modern university has at least six distinct functions.

It conserves knowledge, through library holdings and scholarship. It transmits knowledge by guiding the learning of students and through community education programmes. It advances knowledge through basic research. It applies knowledge by applied research and consultancy. It refines knowledge through critical review and scholarship. It also fulfils the role of certifying standards of entry to a range of professions having different levels of commitment to intellectual endeavour.

The period during which Australian universities have covered this full range of functions has been a comparatively brief one. The emergence of institutions meeting these international criteria arguably dates only from the 1950s when Australian universities began to award the PhD; before then, Australians wishing to be recognised for advancement of knowledge were forced either to travel overseas or enrol as overseas candidates of the University of London.

The adoption of the Murray Report recommendations led to funding of universities at a level which allowed modest

support for basic research. More recently a range of research granting bodies have made it possible for many researchers to obtain reasonable levels of support for their activities. Australian universities have achieved a measure of recognition overseas; for example, an Honours graduate from an Australian university is usually recognised by British universities as being of equivalent standard for the purposes of admission to higher degrees, and our graduates are eagerly sought by reputable American institutions.

It is no exaggeration to say that this hard-

won international reputation is now seriously threatened. A range of reforms which have been brought into the system since John Dawkins replaced Susan Ryan as Minister for Education have substantially undermined the overall capacity of our universities to conduct research and scholarship. Additionally, they have introduced alarming inequities, ushering in a new era in which our degrees and our scholars will no longer receive automatic recognition overseas.

We appear doomed to enter a new Dark Age in which other countries will need to monitor closely which universities and which programmes are still of acceptable standards. The systematic destruction of the capacity of our universities to meet international standards has met remarkably little resistance from our academic leaders, with most Vice-Chancellors falling over each other in their eagerness to collaborate with the Goths at the gate. While FAUSA committees and individual academics rage against the dying of the light, our leaders are marching quietly and purposefully into that night.

The problems are obvious on a broad front. Academic salaries have been systematically depressed by comparison with traditional bench-marks such as CSIRO scientists and in relation to general community wage movements, while any comparison with the salaries of the Commonwealth Public Service is guaranteed to send academics green with envy at the rewards received by the members of that privileged group. Infrastructure in the older universities has been run down to a point which seriously threatens their ability to do what is expected of them, while newer institutions are being denied the services needed to become fully functional universities.

Research resources are clearly inadequate, and the problem will not be alleviated by the current cosmetic policy of attempting to conceal the broad problem by concentrating resources in the hands of a small minority of privileged researchers. The university system is becoming an inverse Achilles, able to deflect tiny arrows of criticism from an armour-plated heel while the rest of the body remains unprotected. While political attention in late 1990 was understandably focused on the continuing scandal of salaries, the other problems are no less urgent. Indeed, they probably deserve more concern. More realistic salaries may halt the flight from academia and restore our ability to recruit from overseas, but that will not arrest the decline of the university system if the resources for research and infrastructure continue to be palpably inadequate.

Research funding:

In 1989, research funding became a

serious political issue. The concern following the 1988 Budget (and public criticism by Barry Jones of its treatment of science) culminated in a thousand protesting scientists standing in the rain at the opening of the National Science and Technology Centre. The embarrassed Prime Minister was reported to have experienced some difficulty in explaining to his Japanese guests the obvious anger of the scientific community. The science statement released in May, 1989 and the subsequent Budget announcements contained some significant initiatives. Though some of the goodwill that was established within the science community was abruptly dissipated by the crass removal of Barry Jones from the post of Minister, there was a temporary second-honeymoon in which the research community held some hopes of better treatment.

Welcomed on all sides was the increase in the number and value of postgraduate scholarships. Funding is being provided in 1990 for 1450 continuing scholarships and 900 new awards. The value was increased to \$12,734 tax-free; while certainly not a princely sum or especially attractive by comparison with the starting salary a good honours graduate might expect, it is a significant improvement on the previous level. Higher education institutions were told that they would be free to increase awards up to \$16,433 tax-free, although funds are only available to allow 10% of awards to be at the higher level. The list of priority areas for such awards was quite extensive, so most universities have been in the invidious position of making very fine judgments between different first-class honours graduates to determine which ones would benefit from the government's largesse.

The issue of additional resources for identifiable research expenditure is a more complex one. The government announced a significant increase in the resources available to the Australian Research Council, but the greater part of these resources came from the operating budgets of the pre-Dawkins universities. Some \$212 million is being transferred over five years from the universities to the ARC, supplemented by \$175 million of "new money" over the same period. These additional resources give the ARC the capacity to fund research infrastructure in addition to specific projects.

There are, however, problems in both these areas. The higher education research infrastructure has been steadily run down over a long period. A survey by the then Department of Science found that an alarming proportion of research equipment was either out of date or inoperable. The research policy committee of FAUSA estimated the shortfall in infrastructure funding as \$100 million. A committee chosen by John Dawkins recommended an injection

of \$65 million over two years. Far from such an injection of funds actually happening, the withdrawal of resources from universities' operating budgets has reduced still further their capacity to provide necessary support for research. The problem has been compounded by the recent government practice of funding growth in student numbers at the marginal rate, with particularly severe impact on those universities which have been forced to grow rapidly.

The government belief that large institutions compensate for their inflexibility by being more "efficient" placed the small universities in a classical dilemma: to retain access to research funds under the new government guidelines, they had to undertake so much inadequately-funded growth in student numbers that their resources were severely stretched to provide the necessary infrastructure. The policy may be helping to achieve budget outcomes and delight those bureaucrats whose only concern is the "bottom line", but it is hardly the way to harness the research potential of the higher education system.

There are also serious problems in the funding of specific projects. In 1989 the ARC was only able to fund about 25% of new applications and 83% of renewal applications; in 1988, 42% of new proposals and over 90% of renewals had been funded. Support from the ARC is the lot of a relatively small minority of academic researchers. Of about 15,000 academic staff in the pre-Dawkins universities, 2321 applied for initial grants in 1989 and 959 applied for renewals. Only 554 new grants and 802 renewals were awarded. Thus fewer than a third of those academics even apply to the ARC and only about 10% actually receive support (given that some of those seeking support for new projects are already being funded for other studies).

It is difficult to avoid the conclusion that the government is systematically running down university research by the parsimony of its funding, for which the generosity of its rhetoric is not a substitute. A recent report by ASTEC, assisted by a respected British analyst of research policy, noted that Australian academic research is underfunded to the extent of over \$300 million annually by comparison with a range of countries in western Europe. The deficiency in government support is particularly marked in the physical sciences and engineering. As the ASTEC media release accompanying the report put it, "Australian government expenditure was rather low, particularly relative to the continental European countries, irrespective of the means used to allow for variation in country size".

Data from the report are tabulated below, giving a comparison of government funding per capita on academic and related research in three areas: General University Funds (GUF), Academic Separately Budgeted

Research (ASBR) and Academically Related Research. Funds allocated to the Institute of Advanced Studies of the ANU and to the Waite Institute are here classified as ASBR, since it is more logical to regard these resources as specific allocations to research activities than to classify them as a part of general university funds.

The only countries which spend less per head on general university funds attributable to research spend much more on ASBR, as is the case for the USA, or on academic-related research (UK, France). Countries such as the Netherlands and West Germany spend about twice as much per head as we do on general university funds for research, as well as spending much more than we do in the other two categories. The ASTEC Report simply states in undeniable terms something which has been apparent for several years; our universities do not have adequate resources for support of research.

Political responses:

The political response to the funding deficiencies throughout the 1980s was to concentrate the limited resources. Based partly on the widespread superstition that the achievement of a "critical mass" is a necessary precursor of high-quality research and partly on the obvious political value of making expenditure more visible by concentrating it in large units, this approach has given us "centres of excellence", special research centres, key centres and now more special research centres.

There are three problems with this approach. The first two arise from the fact that the concentration of resources has negative effects as well as positive ones. Putting the best researchers in charge of centres turns them into research managers; some of our best researchers are also quite outstanding research managers, but not all are. If the establishment of a centre turns a brilliant researcher into an adequate research manager, the net benefit may not be large.

Secondly, it is necessary to take account of what economists call "opportunity costs": in plain English, the problem that a dollar spent on one project cannot be spent on another. A concentration of half a million dollars on one centre is roughly equivalent to about eighteen average-size ARC grants of around \$28,000, so the effect of spending \$0.5 million on a centre should be compared with the alternative of funding nearly twenty typical ARC projects. Such comparisons are rarely undertaken, but it is fair to say that there is little evidence that the concentration of resources achieves measurable disproportionate productivity.

Challenges to the prevailing dogma of "critical mass" typically evoke passionate speeches from vested interests rather than tangible evidence. It has sometimes been suggested that the sort of comparison suggested above is unfair because it

Table 1: Government Research Funds (US\$/head, 1987)

Country	GUF	ASBR	ARR	Total
U.K.	24.8	9.8	12.1	46.7
F.R.G.	47.6	16.4	26.5	90.5
France	21.2	22.1	28.1	71.4
Netherlands	47.7	15.4	14.2	77.2
U.S.A	12.7	40.6	7.9	61.1
Japan	30.4	10.7	4.1	45.2
Australia	26.1	7.1	4.7	42.5

compares the additional impact of ARC funds to an established researcher with the entire cost of a research activity in a centre. That is an intriguing line of defence for the policy of concentration, since the whole point of my argument is that providing additional resources to established researchers whose salaries are already being paid is more likely to be cost-effective than setting up a whole new structure in a stand-alone centre.

The third problem is that the establishment of centres or specialised research institutes creates units which we know will tend to be self-perpetuating, thereby reducing the capacity of the research funding system to respond flexibly to changing priorities. The 1980 special research centres constitute a time capsule, preserving for posterity a picture of the research priorities of a decade ago. I have suggested before that this policy of establishing such centres at regular intervals undoubtedly lays down in successive layers valuable stratigraphic data for future academic historians of science, which could be seen as a service to that particular community of researchers, but it is not at all clear that it represents an optimum allocation of scarce resources.

The May 1989 statement explicitly indicated that only those judged to be the most able researchers could expect to be supported in the future, and that the concentration of resources with the ARC would vest in that body the responsibility for choosing the favoured elite group. There are obvious dangers in moving away from our traditional pluralist model of funding to vest such power in comparatively small discipline panels of three to five people. Not only is there the possible consequence of a monolithic orthodoxy, but there is also the danger of it becoming self-perpetuating. If only those blessed by the ARC have adequate research resources, only those people will be in a position to submit good research proposals to the ARC.

As a specific contemporary example from overseas, granting bodies rejected the two crucial studies which revealed the potential of CFCs to deplete the ozone layer. The work was only done because the researchers concerned, James Lovelock and Sherry Rowland, had access to other resources

(however limited). Moving further toward a situation in which only a small minority of academics will obtain adequate research resources will not only waste the potential of many talented researchers, but will also reduce significantly the diversity in the system. Not all those pursuing unconventional lines of research will produce dramatic leaps forward, but some will; we should be acutely aware of the sacrifices being made for the sake of budgetary restraint.

The "Unified National System"

A new set of problems has been created by the structural arrangements imposed on the university system by the combined effect of government belief in economics of scale and the empire-building ambitions of various Vice-Chancellors. There is some justice in the suggestion that UNS really stands for Under-funded National Shambles, since there is little evidence of system and no evidence at all of a unified approach.

Shorn of lofty rhetoric, what the government has done is essentially to redefine all the colleges as universities in exchange for their agreeing to form bizarre alliances with existing universities or other colleges. There is no need for the alliances to have any structural, educational or social merit; all that is required is that they produce conglomerations having more than 8000 EFTS.

That figure does not appear to be based on organisation theory, overseas experience or educational logic; it is simply an arbitrary figure pulled out of the air. The overall result has been to destroy small and efficient organisations with defined missions and clear links to the local community, allowing the creation of multi-campus monstrosities with no clear focus, no sense of community and no soul. Still, you can't create a desert without cutting down trees...

There are specific implications for research support in the UNS. Having effectively expanded the number of university academics from 15,000 to 26,000 at the stroke of a bureaucratic pen, the government has made it clear that there is no intention to extend to the entire Unified National System the penury which was the fate of the pre-

Dawkins universities. They will not be that generous. Those new universities made by amalgamating former colleges appear doomed to be funded at the same sort of level as before, ensuring that they don't get ideas beyond their station about having full research profiles. Thus it is an integral part of the government plan for the Unified National System that there will be a Brahmin caste of old universities with significant funding for internal allocation to research and a group of Untouchables, the amalgamated groups of former colleges, which will continue to be funded only for teaching.

The caste system needs some intermediate structure between the Brahmins and the Untouchables. In the UNS the institutions destined to fill the middle ground are the universities which have combined with former colleges. Their position is truly invidious. Concerns of internal equity suggest that there should be some attempt at internal re-distribution of their limited research resources to the staff of the former colleges to allow them to become fully functioning members of the new, enlarged university communities.

However, there is a double bind. There are no additional resources for this purpose, so any university seeking to provide equitable resources for the staff of the former college(s) can only fund such an operation at the expense of their other academics. Further, the diversion of the limited resources which are available will be seen by the government as an indication of unwillingness to carry out the instruction to concentrate resources in the hands of the most able researchers. This could be a justification for reducing the university's operating grant. Thus the only way these institutions can maintain their limited research funding is to ignore internal demands for equity and establish a form of academic apartheid in which the staff of former colleges are doomed forever to be the hewers of wood and drawers of water.

No doubt the government and its senior public servants are congratulating themselves on the cleverness of this strategy. The politically difficult calls for more equitable shares of research funds to the colleges have been transformed at a stroke into internal problems for the newly-enlarged institutions. The problem is thus deflected away from the government with some glib talk about the responsibility of universities to manage their resources in the most productive way. Within the enlarged universities, self-interest disguised as the good of the institution does battle with moral duty. There is no prize for guessing the more likely outcome.

The academic division of labour

Not surprisingly, there was considerable interest in the comments of Professor Don

Aitkin, retiring Chair of the Australian Research Council, on the role of research in the university system. Most media attention was concentrated on the observation that "the notion that all academics are good at research (and therefore should be funded to do it) is bunkum". Many saw this assertion as a kind of forward defence of the new academic apartheid being introduced to the Australian university system: failing to fund more than half of the academics for their research is justified by claiming that those not being funded are not "good at research".

The approach has the political appeal of being almost certainly self-sustaining because those denied funding are very unlikely to be able to demonstrate research productivity. A chemist denied laboratory facilities or a social researcher denied survey resources are very unlikely to embarrass the authorities by making major leaps forward.

A variety of government policies are predicated on this sort of notion. The proliferation of fixed-term positions fits into a policy of ensuring that new lecturers don't establish serious long-term research programmes. Since good researchers will inevitably become frustrated if they are denied resources, the government is promoting the idea that we should consciously recruit an under-class of teaching-only academics. The determined effort to place "hard bars" in the salary structure is an integral part of this strategy, because the absence of promotion prevents determined individuals from being rewarded for producing good research without funding, thus subverting the policy. After all, James Lovelock did the measurements which showed the accumulation of CFCs in the atmosphere with equipment scrounged from friends and small items bought from the family housekeeping budget!

Aitkin softens the blow by suggesting that those not funded to do research should be playing other useful roles in the university. He suggested that the modern academic might at different times be contributing to one or more of the following tasks:

- teaching and learning;
- research;
- scholarship;
- collegial administration;
- community service.

It is difficult to take exception to the general notion that the tasks other than research should be taken more seriously and given more formal recognition. There have always been academics whose contribution to student learning is truly exceptional, and the studied failure of universities to recognise that sort of contribution is as much a scandal as the refusal to take seriously allegations of truly appalling lectures. The organisation and critical review of

knowledge has a distinguished role in universities, and is a task which often becomes the major contribution of those whose research loses momentum.

Making universities work in an effective way is no small intellectual and social challenge, and it is reasonable to expect that some of the academic staff will contribute fully to that task. Universities have a responsibility to be part of the local community and contribute to its being informed and humane; many staff play a variety of roles in the area of community service, ranging from being members of advisory bodies to making frequent visits to schools or service clubs. In an ideal world, all academics should play some role in each of these areas, with the balance between them varying over time.

While that general notion is entirely reasonable, it is more difficult to accept the implicit argument that the other tasks of the university should be carried out by those who are not engaged in research. Students have an expectation that they will be stimulated by contact with those academics at the very forefront of the advancement of knowledge. The community is more likely to want to hear from those who are making significant advances than from those who have abandoned their research; certainly government advisory bodies are more interested in the views of those who are seen, rightly or wrongly, as being at the cutting edge of knowledge.

While it is not a good use of human resources to burden productive researchers with loads of administrative, it would be equally undesirable for universities to be run entirely by people who no longer have any active interest in research. Scholarly review requires being sufficiently close to the frontier to understand the significance of claims being made in the literature.

I can support the Aitkin proposal that achievements in these other areas should be given proper recognition as part of the legitimate work of academics, and I have argued forcefully that the distinguished contributions of some of my colleagues to student learning should be fully recognised in promotion cases, but I have real difficulty with the notion that some academics should be assigned to these other tasks as a substitute for research. I am conscious that the time I spend in community service or in committee meetings is time that could otherwise have been spent on research; so long as the choice is mine, I can accept the balancing of different priorities, including the occasional perverse desire for adequate amounts of sleep. A decision from on high that made those choices for me would not be acceptable.

I see running through recent government pronouncements some support for the notion of full-time researchers who do no teaching — after all, that is the effect of establishing research centres — and full-time teachers

who do no research. It perhaps needs to be said publicly much more often that there is an important symbiosis between research and teaching. We often draw attention to the value of students being taught by those who are at the forefront of their discipline or inter-disciplinary area; while this is important, it would be foolish to deny the importance of a commitment to the advancement of learning. Undergraduate students are not well served by exposure to great minds who do not take the trouble to express their advanced ideas in terms which are accessible.

The teaching-research nexus has another benefit which receives insufficient attention: the stimulus to research in the activity of refining ideas to make them accessible to others. It has been wisely said that the best way to learn about a subject is to try to teach someone else about it. I can identify whole areas of my own research which have arisen either from insights arising from putting the subject matter into a logical order for students or from the questions asked by the uninitiated.

It has always interested me that the research output of academics, who spend only a fraction of their time on research, is not significantly lower than the output of full-time researchers in equivalent areas. One explanation for this effect is that teaching acts as a stimulus to research, compensating for the reduced time available. Just as teaching suffers if those doing it are not engaged in research and scholarship, a case can be made that research is more productive if those engaged in it are also forced to express their ideas in a simple and accessible form.

What hope for a clever society?

The economic motivation for becoming a "clever society" is obvious. As a result of following the advice of generations of government economists who have promoted the simplistic doctrine of comparative advantage, our economy is based on the export of bulk commodities — minerals and agricultural produce. The relative value of bulk commodities has been steadily falling against the prices of brain-based goods and services for decades, so our terms of trade have been declining for so long that even the government economists have now noticed. Unless we do something about our ratio of imports to exports of manufactured goods, our continued economic decline is assured.

This does suggest an increased emphasis in areas of technology but it does not justify diminished attention to the humanities and social sciences; after all, most of the reasons for our poor economic performance lie in the management of the production process rather than in narrowly technical areas.

There are various pre-requisites for a clever society, but near the top of the list are

an educated work-force and a vibrant research effort. It would be difficult to make a case that the Commonwealth government is making a serious effort to produce either. As documented above, our research effort is poor by international standards, and the current moves to diminish career opportunities might have been designed to ensure we don't attract the bright young people we need to set their sights on future research opportunities.

The moves to concentrate resources will have the effect of denying many of our academic researchers the tools they need to do the work for which they were recruited. The reduced salaries at all levels of education have systematically steered able young people into areas of less importance, such as company take-overs and other paper-shuffling exercises; indeed, the reward structure we have established would suggest that it is our deliberate aim to be known internationally as an ill-educated country with a real talent for shady corporate activities.

Despite a range of reports which have shown conclusively the nature and scale of the problem, the government has made no serious effort to repair the crumbling infrastructure of the university system.

As an example which cuts right across all areas of inquiry, our university libraries have become steadily less able to keep pace with the demands on them. The same could be said of our public libraries; indeed, it was said fourteen years ago by the Horton committee, and not one of their recommendations has been implemented. University library budgets have increased no faster than the Consumer Price Index, while the prices of books and journals have increased much faster.

The problem has been exacerbated by the falling dollar and the vast increase in the number of published works. Our libraries have made "drastic cuts in their purchases of both monographs and serials"; as a result, our window on the rest of the world's intellectual effort is steadily becoming more opaque. We account for about 2% of the intellectual output of the world, so our libraries are our means of access to the other 98% of work. The introduction of such absurd economic doctrines as the "user-pays" principle is no substitute for adequate resources.

This is the fundamental problem of higher education: the reluctance of government to provide the resources it needs. This is largely a matter of priorities. Whenever a government says that it cannot afford to do something, it is making a statement of priorities; it is giving that proposal a lower priority than any of the activities for which it does find funds. Thus it is implicit that a VIP jet to fly a member of Parliament to a dog show, or a lavish new Parliament House, or generous pensions for senior public servants, or expensive exercises to test our

preparedness to fight enemies we are assured we don't have, are all higher priorities than adequate funding for the university system.

The task of finding resources is complicated by the prevailing Canberra hysteria to reduce the scale of government, demonstrated most memorably when the Treasurer stated in the Budget speech that we now have the third smallest government sector in the entire OECD. Alarmingly, the tone in which the comment was phrased made it clear that the Treasurer regards this as a source of pride rather than national embarrassment, suggesting that he will not rest easily in his taxpayer-subsidised Canberra bed until we have the most inadequate public sector of all. In the absence of other factors, a smaller government sector simply means that the government provides fewer services; in our case, it is directly linked to our expenditure on education being very low by international standards.

Stonier has argued that we need to recognise the key role of education in shaping our future economic destiny. Whereas the indicators of economic prospects were once mineral wealth or productive agricultural areas, in a world economy increasingly dominated by brain-based goods and services the best indicator of a nation's prospects is the education level of its workforce. In those terms, we are making no serious effort to put substance into the rhetoric of the need to become a clever society.

It is difficult to see a political solution to the problem of accumulated neglect of higher education. It was, after all, a Coalition government which began the process of concentrating resources in "centres of excellence", and Coalition policy appears likely to be dominated by the extremist dogma of "economic rationalism". It is difficult to see how the untrammelled play of market forces will make funds available for innovative, curiosity-motivated research. While a back-bench member of the government recently spoke in Parliament in support of the academic salary claim, there is little evidence that either Government or Opposition appreciate the seriousness of the situation.

Conclusion

The capacity of the Australian university system is being steadily undermined by a variety of government policies. These are not simply eroding the infrastructure and destroying career opportunities for individuals, but are now threatening such fundamentals as the uniform commitment to the central values of teaching and research. Acceptance of current policies amounts to collaboration in the erosion of the standing of our universities, their capacity to foster research across a wide range of areas of inquiry, and their capacity to provide

stimulating and relevant educational opportunities. It is incumbent on those who are committed to the excellence of our universities to rage against the dying of the light.

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ARTICLES

A study of counting

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How do you estimate how many new mathematicians (or physicists, or philosophers) we will need to produce to fully staff our universities in the coming years? The equations are quite simple. Decide how many students we expect to be teaching and divide by a suitable student/staff ratio and you come up with the number of teachers you expect to need. Then subtract off the number of staff we already have, add the number of staff who are expected to retire, and then make a few adjustments for the people who will come and go between the academic workforce and the outside world.

The problem of course is not in the equations, but in estimating the quantities involved. In 1989, Dr Ian Allen of the Victorian Post-Secondary Education Commission prepared a discussion paper, *Staffing implications of growth in higher education* (Allen 1989), which addressed the question of whether Australia was going to be able to produce enough academics to cater for the large growth in the higher education system planned for the next few years. His conclusions are quite startling; a shortfall of over 5000 academic staff over all disciplines by 1991 and perhaps as many as 12,000 by 1994. This paper has been an important factor in policy decisions at both the university and government levels.

The staffing situation varies greatly from one discipline to another and Allen makes an attempt in his report to estimate future requirements for various subject areas. Much of the planned growth is in business studies and engineering, for example, so it is natural that these subjects will suffer staffing difficulties. And the higher salaries offered outside the university system have already resulted in severe staff shortages in several areas.

An unfortunate aspect of Allen's report is that it seriously underestimates the shortages that will occur in mathematics.

Allen based his figures on the number of studies taking that discipline as their major area of study — not on the teaching load generated in that area. For subjects like mathematics which perform substantial service teaching roles in the universities, this gives a very inaccurate measure of how the increase in student numbers will affect them.

Even if there were to be no increase in mathematics majors, the expected 5000 increase in engineering students over the 1989-91 triennium would produce an increased teaching load for mathematics of about 700 EFTSUs. In fact, an increase in student numbers in almost any field causes some increase in teaching load in mathematics.

Some idea of how much of the burden mathematics carries is given by the fact that at my university, 21 per cent of the 405 EFTSU increase in teaching load last year fell in mathematics. By comparing the areas of planned student number expansion with the mathematics components of those courses, it seems that we should expect that, of the 62,550 increase in student numbers planned over the present triennium, mathematics will have to deal with an increased load of 5000 EFTSUs. At Allen's quoted student/staff ratio of 16:1 that corresponds to an extra 320 academic mathematicians required — much larger than Allen's estimate of 93.

This does not even take into account the number of mathematicians expected to retire over the next few years. Allen estimates that over 300 academic staff will be required to replace lost staff in mathematics, computer science and information systems over the

present triennium. In some mathematics departments as many as one third of the tenured staff will retire over the next decade.

Can we cope? At present Australia produces between 45 and 70 people per year with research higher degrees in mathematics. Many of these are foreign students who will return home after the completion of their degrees. A large percentage of them would also be expected to obtain jobs in industry. And given that the United States is also going into a period where they have a shortage of Ph.D. trained mathematicians, many Australian graduate students studying there may not return.

This raises the prospect that Australia will face a shortfall of several hundred academic mathematicians over the next few years — a shortfall that would not be satisfied even if all the honours students in mathematics (between 102 and 164 over the past few years Petocz, 1988) went on to postgraduate study. Recent figures produced by Dr V.G. Hart of the University of Queensland found 76 vacancies for higher degree trained mathematicians advertised in just one newspaper, *The Australian*, between July 1989 and July 1990.

At present we are probably getting by on the surplus of PhD graduates produced during the 1980s. Many of these graduates are only now finding their first permanent jobs after a long succession of postdoctoral positions. This surplus will perhaps give us a buffer of a year or two before the situation becomes critical, but already it is becoming difficult to attract new staff to the more junior positions in universities, especially in Sydney and Melbourne. The recent increase in the value of postgraduate scholarships will hopefully help the situation, but the real problem is a shortage of well-qualified

students applying to study mathematics at the undergraduate level.

One variable I have not yet discussed is the student/staff ratio. If we let our class sizes grow we can of course cater for more students without any increase in staff numbers. This seems to be one of the preferred methods of coping with the problem. At the University of New South Wales, the student/staff ratio has risen from 13.7 in 1986 to over 17 this year. Whilst this is an admirable productivity increase, little consideration seems to have been given to the quality of the product which we produce.

Does it matter if mathematics departments are short-staffed? I think it does — and for the very reasons that Allen's figures are wrong. There are at least four important groups of students in our mathematics classes: (i) students taking mathematics as part of another course; (ii) future mathematics teachers; (iii) future professional mathematicians for industry, commerce and science; and (iv) future mathematics postgraduates.

Destroying the gift: rationalising research in the humanities¹

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The current restructuring of tertiary education in Australia is a cause for lament, but not for surprise. The modern university, in this country as elsewhere, has long been an enclave of non-market values in a world increasingly pressed into the market mould. It was as predictable that the university — cradle of ideas — should eventually face the bulldozers as that the rainforest — cradle of life — should do so.

Indeed there are deep ideological links between the present defence of the universities and the defence of the natural environment. The environmental movement seeks to preserve the natural world — our natural heritage — at least in part for its own sake, as an end in itself. The defender of the universities seeks to preserve our intellectual heritage for the same kind of reason. In this sense both these 'movements' are conservative — both are striving to protect a fundamental source or locus of value not analysable in instrumental terms. Their common enemy is the ideology of instrumentalism, the system which denies a space for existence to anything that does not directly serve the interests of the economy.

We hear a lot these days about the evils of such instrumentalism, or economic rationalism, both in relation to the universities and

Mathematics is the cornerstone of many other subject areas, from engineering to economics. We cannot produce world class engineers if their mathematics education is lacking. If our teachers are not well trained, the effects will spread throughout the whole education system. Larger classes do affect the quality of education we give our students. It is very difficult to explain even moderately complicated concepts to first year undergraduates when their tutorial classes have 30 students and their lectures many times that number. Some universities have chosen to give up teaching the hard concepts, others incur very high failure rates. Neither is a very acceptable option.

Mathematics is a matter of national importance in Australia. Not just in our schools but also in our universities. Unless we make a major effort to encourage those at school who are strong at mathematics to choose this as a career, then we face enormous difficulties providing Australian university students with the mathematical

education which they need if Australia is indeed to become the 'clever country'.

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Until the present restructuring of the universities was set in motion, research in the humanities was not organised strictly on the production model, though considerations of 'productivity' were of course present. The universities provided a framework within which academics could pursue their research in their own time and, to a certain extent, at their own pace. Researchers were expected to exercise their own expert judgement in arriving at research topics, and were under no obligation to ensure that there was in any sense a pre-existing 'demand' for their particular investigations. Within the humanities, specific funding for research was relatively incidental; time, both for the actual writing and the intellectual gestation of works, was the primary desideratum. The universities were reasonably effective in satisfying this requirement. (For a recent discussion of the past and present systems of funding research in the humanities see Knight, 1989a, Aitken, 1989 and Knight, 1989b).

In the new regime inaugurated by Dawkins, all research in the universities is organised according to a single set of guidelines. No effective provision is made for the different requirements of research in the humanities and research in law or engineer-